

1 WHAT IS CLAIMED IS:

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1. An MR (Magnetoresistance effect) head
comprising:

 a slider; and

 a film structure part which is located on an
10 air outflow side of the slider and includes an MR
element for reproducing,

 the film structure part having an end
surface located on an identical side as a floating
surface of the slider,

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 the end surface of the film structure part
and the floating surface of the slider forming a step-
like recess which has a depth making it possible to
prevent a fine projection on a magnetic disk from
hitting the end surface of the film structure part.

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2. The MR head as claimed in claim 1,
25 wherein the depth of the step-like recess causes an
end of the MR element on the end surface of the film
structure part to be located on or above an imaginary
line which passes through a rear edge of the slider
and said end of the MR head when the MR head is in a
30 floating state at a given angle.

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3. The MR head as claimed in claim 1,
wherein:

 the depth of the step-like recess has a

1 length equal to or greater than a sum of a first
length and a second length;

the first length causes an end of the MR
element on the end surface of the film structure part
5 to be located on an imaginary line which passes
through a read edge of the slider that is in a
floating state at a given angle and which is parallel
to the magnetic disk; and

the second length corresponds to a magnitude
10 of a swelling of the end surface of the film structure
part, said swelling being formed when the film
structure part is thermally deformed.

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4. The MR head as claimed in claim 1,
wherein:

the depth of the step-like recess has a
20 length equal to or greater than a sum of a first
length and a second length;

the first length causes an end of the MR
element on the end surface of the film structure part
to be located on an imaginary line which passes
25 through a read edge of the slider that is in a
floating state at a given angle and which is parallel
to the magnetic disk; and

the second length corresponds to a
descending movement of the MR head after the MR head
30 is pushed upwardly by the fine projection, said
descending movement including an overshooting
movement.

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5. The MR head as claimed in claim 1,

1 wherein:

the depth of the step-like recess has a length equal to or greater than a sum of a first length, a second length, and a third length;

5 the first length causes an end of the MR element on the end surface of the film structure part to be located on an imaginary line which passes through a read edge of the slider that is in a floating state at a given angle and which is parallel
10 to the magnetic disk;

the second length corresponds to a magnitude of a swelling of the end surface of the film structure part, said swelling being formed when the film structure part is thermally deformed; and

15 the third length corresponds to a descending movement of the MR head after the MR head is pushed upwardly by the fine projection, said descending movement including an overshooting movement.

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6. The MR head as claimed in claim 1,
wherein the depth of the step-like recess satisfies
25 the following condition:

$$Y1 \geq t1 \times \tan \alpha$$

where Y1 is the depth of the step-like recess, t1 is a
30 distance between an air outflow end of the slider and the MR element, and α is the floating angle.

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7. The MR head as claimed in claim 1,
wherein the depth of the step-like recess satisfies

1 the following condition:

$$Y3 \geq (t1 \times \tan\alpha) + Nh$$

5 where Y3 is the depth of the step-like recess, t1 is a distance between an air outflow end of the slider and the MR element, α is the floating angle, and Nh is a magnitude of a swelling of the end surface of the film structure part, said swelling being formed when the
10 film structure part is thermally deformed.

15 8. The MR head as claimed in claim 1, wherein the depth of the step-like recess satisfies the following condition:

$$Y4 \geq (t1 \times \tan\alpha) + Z$$

20 where Y4 is the depth of the step-like recess, t1 is a distance between an air outflow end of the slider and the MR element, α is the floating angle, and Z is a descending movement of the MR head after the MR head
25 is pushed upwardly by the fine projection, said descending movement including an overshooting movement.

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9. The MR head as claimed in claim 1, wherein the depth of the step-like recess satisfies the following condition:

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$$Y5 \geq (t1 \times \tan\alpha) + Nh + Z$$

1 where Y5 is the depth of the step-like recess, t1 is a
distance between an air outflow end of the slider and
the MR element, α is the floating angle, Nh is a
5 magnitude of a swelling of the end surface of the film
structure part, said swelling being formed when the
film structure part is thermally deformed, and Z is a
descending movement of the MR head after the MR head
is pushed upwardly by the fine projection, said
10 descending movement including an overshooting
movement.

15 10. An MR (MagnetoResistance effect) head
comprising:
a slider; and
a film structure part which is located on an
air outflow side of the slider and includes an MR
20 element for reproducing,
the film structure part having an end
surface located on an identical side as a floating
surface of the slider,
the end surface of the film structure part
25 and the floating surface of the slider forming a step-
like recess which has a depth making it possible to
prevent a fine projection on a magnetic disk from
hitting the end surface of the film structure part,
and causes a first rear edge of the film structure
30 part to be located on or above an imaginary line which
passes through the first rear edge of the film
structure part and a second rear edge of the slider
when the MR head is in a floating state at a given
angle.

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1 11. The MR head as claimed in claim 10,
wherein the depth of the step-like recess satisfies
the following condition:

5 $Y2 \geq t2 \times \tan \alpha$

where Y2 is the depth of the step-like recess, t2 is a
thickness of the film structure part, and α is the
floating angle.

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12. The MR head as claimed in claim 10,
15 wherein the depth of the step-like recess satisfies
the following condition:

$$Y3' \geq (t2 \times \tan \alpha) + Nh$$

20 where Y3' is the depth of the step-like recess, t2 is
a thickness of the film structure part, α is the
floating angle, and Nh is a magnitude of a swelling of
the end surface of the film structure part, said
swelling being formed when the film structure part is
25 thermally deformed.

30 13. The MR head as claimed in claim 10,
wherein the depth of the step-like recess satisfies
the following condition:

$$Y4' \geq (t2 \times \tan \alpha) + Z$$

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where Y4' is the depth of the step-like recess, t2 is
a thickness of the film structure part, α is the

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1 floating angle, and Z is a descending movement of the
MR head after the MR head is pushed upwardly by the
fine projection, said descending movement including an
overshooting movement.

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14. The MR head as claimed in claim 10,
10 wherein the depth of the step-like recess satisfies
the following condition:

$$Y5' \geq (t2 \times \tan \alpha) + Nh + Z$$

15 where Y5' is the depth of the step-like recess, t2 is
a thickness of the film structure part, α is the
floating angle, Nh is a magnitude of a swelling of the
end surface of the film structure part, said swelling
being formed when the film structure part is thermally
20 deformed, and Z is a descending movement of the MR
head after the MR head is pushed upwardly by the fine
projection, said descending movement including an
overshooting movement.

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15. A magnetic disk apparatus comprising:
a magnetic disk;
30 an MR (Magnetoresistance effect) head; and
a supporting member which movably supports
the MR head above the magnetic disk,
said MR head comprising:
a slider; and
35 a film structure part which is located on an
air outflow side of the slider and includes an MR
element for reproducing,

1 the film structure part having an end
surface located on an identical side as a floating
surface of the slider,
 the end surface of the film structure part
5 and the floating surface of the slider forming a step-
like recess which has a depth making it possible to
prevent a fine projection on a magnetic disk from
hitting the end surface of the film structure part.

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16. The magnetic disk apparatus as claimed
in claim 15, wherein:
15 the supporting member comprises a suspension
to which the MR head is fixed, and patterned wiring
lines formed on the suspension; and
 ball members which are made of an
electrically conductive material and connect terminals
20 of the MR head and the patterned wiring lines.

25 17. A magnetic disk apparatus comprising:
a magnetic disk;
an MR (MagnetoResistance effect) head; and
a supporting member which movably supports
the MR head above the magnetic disk,
30 said MR head comprising:
a slider; and
a film structure part which is located on an
air outflow side of the slider and includes an MR
element for reproducing,
35 the film structure part having an end
surface located on an identical side as a floating
surface of the slider,

1 the end surface of the film structure part
and the floating surface of the slider forming a step-
like recess which has a depth making it possible to
prevent a fine projection on a magnetic disk from
5 hitting the end surface of the film structure part,
and causes a first rear edge of the film structure
part to be located on or above an imaginary line which
passes through the first rear edge of the film
structure part and a second rear edge of the slider
10 when the MR head is in a floating state at a given
angle.

15 18. The magnetic disk apparatus as claimed
in claim 17, wherein:
 the supporting member comprises a suspension
to which the MR head is fixed, and patterned wiring
20 lines formed on the suspension; and
 ball members which are made of an
electrically conductive material and connect terminals
of the MR head and the patterned wiring lines.

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